

FANG HISTOLOGY OF THE LATE DEVONIAN TRISTICHOPTERID HYNERIA LINDAE THOMSON, 1968

Memoirs of the Queensland Museum – Nature 56(2): 311–311. 2013. Tooth and fang histology in many Palaeozoic amphibians is characterised by infolding of pleats of orthodentine (plicidentine), giving the tooth or fang a labyrinthodont structure (Schultze 1969, 1970; Warren & Davey 1992; Warren & Turner 2005). Folded orthodentine also occurs in some sarcopterygian fish, including osteolepiforms, porolepiforms, and rhizodonts (Schultze 1969, 1970; Ahlberg & Johanson 1998; Warren & Turner 2005). The tooth and fang histology of many members of the Tristichopteridae Cope, 1889, a Middle to Late Devonian osteolepiform clade, has been studied previously (e.g. Vorobyeva 1959, 1962, 1977; Schultze 1969; Lelièvre & Janvier 1986; Clément 2002). Currently, two distinct folding morphologies are recognised in tristichopterids, the simpler polyplocodont type, and the more complex eusthenodont type, the latter characterised by more extensive orthodentine infolding and a pulp cavity filled with osteodentine (Schultze 1969, 1970).

The large, derived tristichopterid *Hyneria lindae* Thomson, 1968 was first described on the basis of limited material from the Upper Devonian (Famennian) Catskill Formation of Pennsylvania, United States of America, from a site now known as ‘Red Hill’. Renewed excavations at the site since 1993 have yielded additional material of this taxon, which is yet to be described (Daeschler & Shubin 2007). This note describes the histology observed in a fang of *H. lindae*. Fangs are distinguished from teeth in their large size relative to adjacent teeth (Bolt & Lombard 2001), and also in their unique pattern of development and replacement: they occur in distinct pairs, with eruption and replacement occurring in an alternating pattern (Fox *et al.* 1995; Snitting 2008; Clément *et al.* 2009).

Material and Methods. A near complete (missing only the tip) fang of *H. lindae*, measuring 35 mm long with a maximum basal diameter of 15 mm, was provided to me by Dr E. B. Daeschler for examination. The isolated fang is laterally compressed, carinated both anteriorly and posteriorly, curved posteromesially and probably came from the dermopalatine or ectopterygoid (E.B. Daeschler, pers. comm. 2011). The orthodentine is well preserved in part of the fang, but has undergone significant alteration in other parts. In the poorly preserved parts the orthodentine folds have turned dark brown or been obliterated completely, leaving a crumbly brown residue which renders the fang too fragile for thin sectioning. To permit sectioning the fang was embedded in resin (Renlam 100), and two polished sections one 8 mm from the base, the other 14 mm from the base were made. The specimen, QMF 56172, is now housed in the Geosciences Collection of the Queensland Museum.

Description. Orthodentine folds are most clearly observed near the base of the fang (Fig. 1). Orthodentine is very intensely folded into both first- and second-order folds (*sensu* Vorobyeva 1962). The total number of first-order folds in the specimen cannot be exactly determined (but is estimated to be approximately 30 at the base). The number of second-order folds per first-order fold could not be determined. Folded orthodentine extends about 3 mm in toward the centre of the fang; the remaining central region consists of osteodentine, with small vascular canals still visible despite the alteration (Fig. 1A). Dentine tubules are not visible, due to the specimen being a polished section examinable only under reflected light.

Orthodentine folding is extremely tight, with individual second-order folds pressed against each other such that there is little or no room for osteodentine or bone in between. This produces a ‘branched zig zag’ geometry in individual folds (Warren & Turner 2005). The overall histology of the orthodentine thus presents itself as a very regular ‘hexagonal’ pattern, resulting from the tightly compressed second-order folds (Fig. 1B).

Comparison to other Taxa. *Hyneria lindae* displays a peculiar and unique fang histology which combines features observed in a number of different sarcopterygian groups. The pulp cavity is filled with osteodentine, a eusthenodont characteristic observed in the tristichopterids *Eusthenodon* (Schultze 1969), *Langlieria* (Clément 2002; Clément *et al.* 2009), *Platycephalichthys* and *Jarvikinia* (Vorobyeva 1959, 1962, 1977), as well as the osteolepiform *Litoptychus* (Schultze 1969). However, the hexagonal folding pattern of orthodentine in *H. lindae* is far more regular and complex than in any known tristichopterid (cf. Vorobyeva 1959, 1962, 1977; Schultze 1969; Clément 2002); the fang histology in the genera *Mandageria* and *Cabonichthys* cannot be described from the existing material (P.E. Ahlberg, pers. comm. 2011).

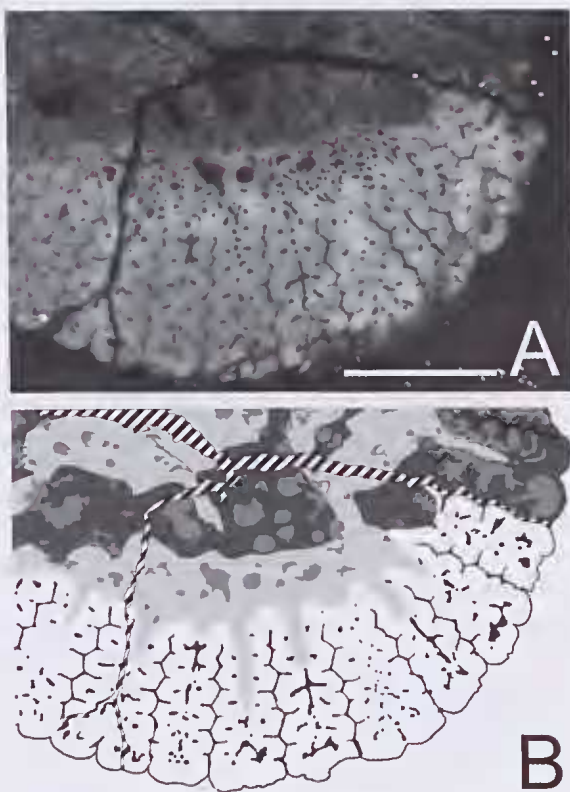


FIG. 1. Histology of *Hyneria lindae* fang, showing the distinctive ‘hexagonal’ orthodentine folding pattern. A, microphotograph of 8 mm parabal section of QMF 56172; scale bar is 3 mm. B, interpretive drawing of the section in A. In B, white represents more or less unaltered orthodentine, black represents natural spaces between orthodentine folds, dark grey represents areas of significant alteration, medium grey represents dissolution cavities formed possibly through diagenesis, light grey indicates more or less unaltered osteodentine and diagonal hatching represents fractures.

It is more similar to the dendrodont pattern observed in porolepiforms (Schultze 1969, 1970; Holland 2010) and in some temnospondyls (Schultze 1969; Warren & Davey 1992), although in all of these forms it is less regular and complex than observed in *H. lindae*. Additionally, there does not appear to be any bone of attachment extending between the folds in *H. lindae*, at least as can be determined from the section near the base, which is also a dendrodont characteristic (Schultze 1969, 1970). This combination of characters prevents *H. lindae* being assigned to a distinct type of fang histology, although it is most similar to the dendrodont pattern. It is clear, however, that it is not of the polyplocodont type, which within the Tristichopteridae is considered to be restricted to more primitive members, namely *Eusthenopteron*, *Tristichopterus* (Schultze 1969, 1970) and *Notorhizodon* (Young *et al.* 1992), as well as an incomplete specimen from Morocco (Lelièvre & Janvier 1986).

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